

# Predictive Model for Archaeological Resources

Marine Corps Base Quantico,  
Virginia

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# Predictive Modeling: A Brief Description

- **Predictive Modeling for Archaeological Sites** uses known environmental and geophysical correlates of sites, direct historical information, theory of settlement and subsistence systems, and archaeological data substantiating these to identify areas with varying degrees of archaeological potential.

# Technology

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- **The GIS (Geographic Information System) Shop, at Marine Corps Base Quantico is assisting in applying Arc View GIS and spatial analysis technology**
- **GPS Location of Sites and Unit level inclusion of data in GIS: Mapping Shovel Tests and Surface Finds**
- **Site vs. Non-site Grid Squares, Rather than raw numbers of sites as points falling within areas.**

# Team/Resources

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## Personnel

- **John Haynes**, *Archaeologist, MCB Quantico*
- **Jesse Bellavance**, *GIS Contractor, Egan-McAlister*

## Technical Resources

- **ArcView Based GIS**
- **Data Accumulated from over 50 Cultural Resources Surveys**
- **GPS Site Location**
- **Utilization of VDHR Data Sharing System Site files of Areas Comparable to the Base**

# Research Context: Is archaeological predictive modeling coming of age?

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- The number and scope of archaeological predictive model projects continues to grow, with many trials for improving methods.
- GIS software is providing new tools for analysis, and GPS devices are adding accuracy to surveys. Review of predictive models and their use of GIS has added to our predictive model development at Quantico.

# Research Context: Is archaeological predictive modeling coming of age? Continued

- Has survey work aboard Quantico reached a 'critical mass' of data for predictive modeling? Extensive areas already surveyed for Section 106 and Section 110 compliance at MCB Quantico now amount to nearly 10% of the 60,000 acre Base land area.
- The Virginia Department of Historic Resources has begun a computerization of its site files in a 'Data Sharing System' improving access to its files.
- As data compiled through Section 106 compliance surveys mounts across the country, the data base improves. Northern Virginia has had extensive surveys for compliance, and county programs.

# Forward to the test of our approach...

- Many predictive models have relied on simple correlation of geophysical and environmental factors with archaeological sites. This is a drawback as correlations may be spurious, or act as proxies for covariant factors even where they have no causal relation to settlement/mobility decision making behavior.
- The final stage of this model will be a deductive approach: Existing models of prehistoric settlement/mobility behavior will be tested using archaeological data to identify the environmental and geophysical correlates of archaeological site areas, as well as those of non-site areas.

# Forward to the test of our approach...Continued

- Site areas and non-site areas are defined as any cell of a grid covering the previously surveyed sample area (i.e., population) that is positive or negative for the presence of archaeological resources.
- Sampling within the previously surveyed areas, using a stratified random design to maximize even coverage of geophysical diversity and minimize biases – will obtain an accurate measure of the density and distributional characteristics of sites for the ‘universal’ population of all areas of the Base.

# Project Stages and Tasks

STAGE 1	STAGE 2	STAGE 3
<b>Task 1) <u>Improve Data Base</u></b> <ul style="list-style-type: none"> <li>➤ Map All Previous Surveys in GIS</li> <li>➤ Map Site Areas with Data</li> <li>➤ Data Base of Sites/Survey Reports</li> </ul>	<b>Task 4) <u>Create List of Variables</u></b> <ul style="list-style-type: none"> <li>➤ Geophysical Site Variables</li> <li>➤ Subsistence Catchments</li> <li>➤ Transit Corridors</li> </ul>	<b>Task 7) <u>Testing Sample Development</u></b> <ul style="list-style-type: none"> <li>➤ Raster Grid of MCBQ in 10 Meter Squares</li> <li>➤ Percentages of Geophysical Areas</li> <li>➤ Percent of MCBQ Surveyed</li> <li>➤ Portion of Surveyed Areas 'Site Areas'</li> </ul>
<b>Task 2) <u>Review Literature</u></b> <ul style="list-style-type: none"> <li>➤ Method and Theory of Predictive Modeling</li> <li>➤ Predictive Models, and Settlement Mobility Theory</li> </ul>	<b>Task 5) <u>Training Sample</u></b> <ul style="list-style-type: none"> <li>➤ Compile List of Sites from DSS for inclusion</li> <li>➤ Develop Coefficients for Variables</li> <li>➤ Rank Variables for Efficacy</li> </ul>	<b>Task 8) <u>Test Model Against The Testing Sample</u></b> <ul style="list-style-type: none"> <li>➤ Random Sample of the Surveyed Portions of MCBQ, Stratified According to Geophysical Area</li> <li>➤ Rank Predictive Power of Variables and Hierarchical Convergence Rank-Mapping System Components</li> </ul>
<b>Task 3) <u>Develop Research Design</u></b> <ul style="list-style-type: none"> <li>➤ Schedule and Scope</li> <li>➤ Methodological Framework</li> <li>➤ Substantive Elements: Prehistory</li> </ul>	<b>Task 6) <u>Map Probability Areas</u></b> <ul style="list-style-type: none"> <li>➤ Select Most Effective Variables Identified in Task 5.</li> <li>➤ Define Buffers, Distance, and Catchment Variables</li> <li>➤ Create Hierarchical Convergence Rank-Mapping System</li> </ul>	<b>Task 9) <u>Refine, Adjust, and Renew</u></b> <ul style="list-style-type: none"> <li>➤ Realign the Hierarchical Convergence Rank-Mapping System According to Test Results</li> <li>➤ Ongoing Data Accumulation and Data Base Improvement</li> <li>➤ Monitor Predictive Power of The Model, and realign and retest if significant differences are noted.</li> </ul>

# STAGE 1

## **Task 1) Improve Data Base**

- **Map All Previous Surveys in GIS**
- **Map Site Areas with Data**
- **Data Base of Sites/Survey Reports**

## **Task 2) Review Literature**

- **Method and Theory of Predictive Modeling**
- **Predictive Models, and Settlement Mobility Theory**

## **Task 3) Develop Research Design**

- **Schedule and Scope**
- **Methodological Framework**
- **Substantive Elements: Prehistory**

# STAGE 2

## **Task 4) Create List of Variables**

- **Geophysical Site Variables**
- **Subsistence Catchments**
- **Transit Corridors**

## **Task 5) Training Sample**

- **Compile List of Sites from DSS for inclusion**
- **Develop Coefficients for Variables**
- **Rank Variables for Efficacy**

## **Task 6) Map Probability Areas**

- **Select Most Effective Variables Identified in Task 5.**
- **Define Buffers, Distance, and Catchment Variables**
- **Create Hierarchical Convergence Rank-Mapping System**

# STAGE 3

## Task 7) Testing Sample Development

- **Raster Grid of MCBQ in 10 Meter Squares**
- **Percentages of Geophysical Areas**
- **Percent of MCBQ Surveyed**
- **Portion of Surveyed Areas 'Site Areas'**

## Task 8) Test Model Against The Testing Sample

- **Random Sample of the Surveyed Portions of MCBQ, Stratified According to Geophysical Area**
- **Rank Predictive Power of Variables and Hierarchical Convergence Rank-Mapping System Components**

## Task 9) Refine, Adjust, and Renew

- **Realign the Hierarchical Convergence Rank-Mapping System According to Test Results**
- **Ongoing Data Accumulation and Data Base Improvement**
- **Monitor Predictive Power of The Model, and realign and retest if significant differences are noted.**